

# Harnessing the Power of Nitric Oxide for Therapeutic Application in Dermatology



Leon H. Kircik MD

**D**ermatology is a field long associated with innovation. From the early days of the specialty, all the way from using medicated soaps with tar and sulphur to compounding various concoctions, to the ongoing expansion of the biologics today, dermatology has been focused on adopting unique solutions to common problems.

The pace of innovation continues with the development of nitric oxide (NO) as a topical therapeutic agent. This novel investigational molecule for the treatment of acne vulgaris addresses two significant issues. It offers a new approach to managing one of the most common skin diseases we encounter every day in our offices. And it does so while eliminating a growing clinical concern: the rise of bacterial resistance.

Nitric oxide has long been known to provide immunomodulatory and antimicrobial effects when endogenously expressed. However, researchers continue to elucidate a wide range of physiologic and immunologic functions. Only recently have formulators achieved success in harnessing the power of nitric oxide for therapeutic application. A stable, topical formulation that will release an appropriate concentration of NO to the target site had been elusive.

Topical formulations now under investigation show promise for the treatment of acne, and researchers and clinicians have an eye toward other infectious and inflammatory cutaneous conditions, such as wound healing, warts, and onychomycosis. In systemic forms, NO is also under investigation for non-dermatologic indications.

The emergence of NO as a possible topical treatment for acne is significant. Nitric oxide's anti-inflammatory properties are well documented. NO's anti-inflammatory actions include inhibition of IL-1 $\beta$  and Th17 activation. Increasingly, dermatologists are recognizing that acne is essentially an inflammatory skin disease—even if we continue to use imprecise terms like “inflammatory” and “non-inflammatory” to characterize lesions. Similarly, we are recognizing that inflammation underlies virtually all the common presentations we see in the dermatology clinic.

On the other hand, dermatologists continue to grapple with the challenges of antibiotic resistance and their role in reducing it. Even as global guidelines recommend a reduction in use of antibiotics to treat acne, they are still continued to be considered essential to treatment. The data to date show that nitric oxide's antimicrobial effects lead to a reduction in *P. acnes*. Yet, at high concentrations, NO has not been associated with the development of bacterial resistance.

As discussed ahead, topical NO represents an important potential therapeutic option for the treatment of acne and possibly other dermatoses. Now that formulators have overcome the challenges of topical delivery, clinicians can be optimistic that topically applied NO may become available for the safe and effective treatment of acne, warts, onychomycosis, and other inflammatory dermatologic diseases in the near future. Importantly, this novel treatment does not appear to contribute to the global problem of bacterial resistance while providing a novel approach to management of decades old common cutaneous disorders. Once again, dermatology is identifying an elegant solution to our unmet clinical needs.

## Leon H. Kircik MD

*Indiana University School of Medicine, Indianapolis, IN  
Mount Sinai Medical Center, New York, NY  
Physicians Skin Care, PLLC, Louisville, KY  
DermResearch, PLLC, Louisville, KY*

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